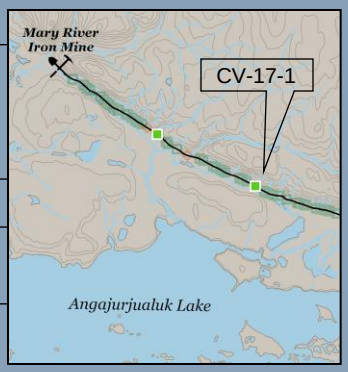
Mary River Iron Mine
Nunavut Water Board Water License
Application Section 9
Representative Crossing Summary Sheet

CV-17-1

Zone: 17W
Easting: 5578068
Northing: 7902643
Station: 17+890

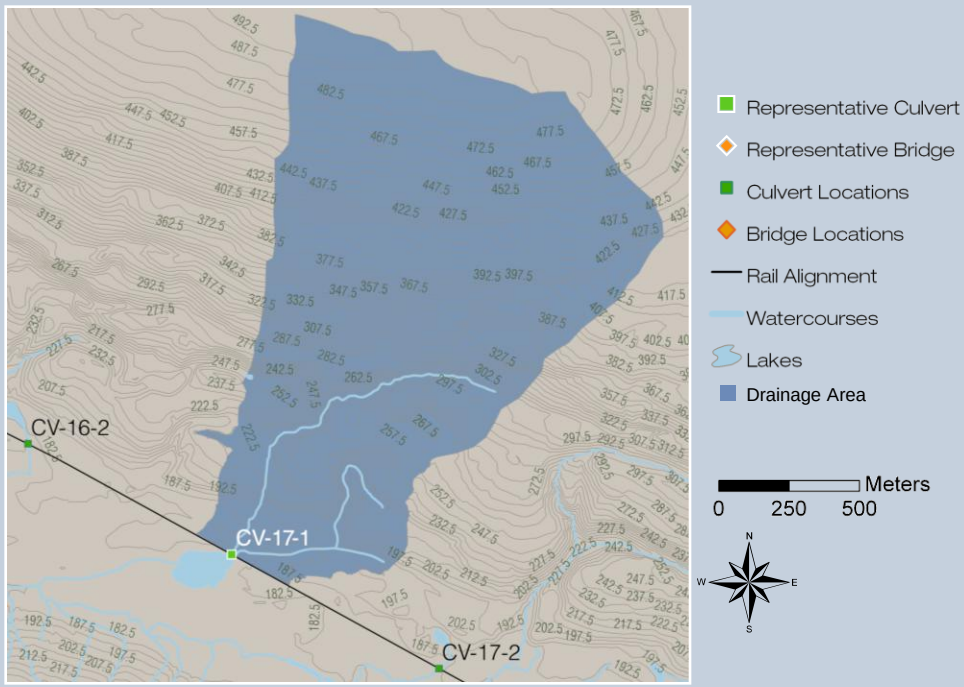
Fish Habitat	Important fish habitat
Structure Design	No. Barrels: 2 Diameter: 3m Length: 89m Slope: 1.7 %
Drainage Area	1.54 km^2
Design Flow	10 yr 3 day delay = 0.56 m^3/s 200-yr = 5.35 m^3/s
Velocity per Barrel	10 yr 3 day delay = 1.61 m/s 200 yr = 2.68 m/s



Description of Crossing Structure

The representative culvert CV-17-1 is located approximately 5.6 km north of the eastern end of Angjurjualuk Lake and 15 km west of the Ravn River. CV-17-1 will use two 3 m diameter culverts approximately 89 m in length, embedded by 20% of the diameter in the substrate. This location is not a combined crossing with the access road. Rail embankment slopes will be reduced to 1:5:1 with 9.0 m of fill over the culvert invert; the projected 25 yr settlement is less than 0.4 m.

One stream channel (labeled Trib. 1 in Photo 1) will be re-aligned to redirect the stream to the CV-17-1 crossing. In addition to the channelization, a portion of the downstream pond will be infilled to allow for the rail embankment slope.



Crossing Construction

Machinery to be used for the construction includes trucks, crane, backhoe (for spoils removal) Materials and machinery will be transported to and from the site on an access road or on the rail alignment.

Crossing construction will occur in frozen conditions and thus there will be no water flow during construction and fish passage will not be interrupted. Temporary crossing of the watercourse will be required and will be constructed using a snow fill or Ice Bridge in accordance with applicable DFO, Nunavut Operation Statement.

The temporary watercourse crossing will remain in place for the duration of the culvert construction only and will be removed as soon as possible. The temporary crossing will not impact water flow as it will be removed prior to the spring melt.

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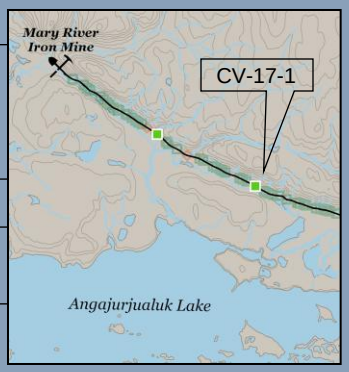
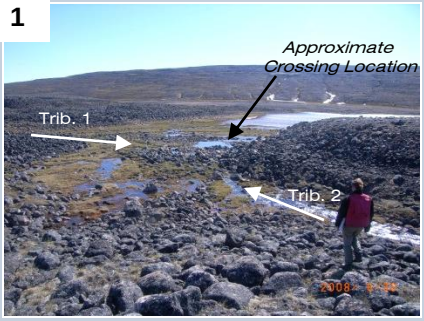


Site Photos

1



2

3

Photo 1 is annotated to identify the two tributary streams. Photos 2 and 3 are of Tributary 1 and 2 respectively at the crossing site.

Existing Conditions at Crossing Site

The crossing location is a small area between three hills and a pond (LE-017-1), which is fed by two streams. The two streams have very small flows. The south stream is contained in one channel as it drops down the hillside. When it reaches the flat area it is lost somewhat in between boulders. One stream (Trib. 1) will be channelized upstream of the rail embankment to CV-17-1. CV-17-1 was assessed as important fish habitat for both Arctic char and ninespine stickleback based on the potential for rearing habitat (high potential for Arctic char and low for ninespine stickleback). The anticipated footprint of habitat loss is 0.08 ha.

Navigability	Not navigable	
Width and Depth	Bankfull width: not measured (many small channels) Wetted width: 7.3 m Maximum Depth: 0.25 m	
Substrate and Vegetation	Channel Morphology: 90% Pool, 10% cascade Substrate Composition: 60% Fines, 20% Cobble, 20% Boulder Stream Cover: 20% boulder	
Channel Meander Pattern	Floodplain Width (m): 56.7 m Channel Pattern: braided Channel Confinement: Unconfined Channel Gradient: 1º	Channel Gradient: 1o Bank Height (L/R; m): 0.01/0.05 Bank Shape (L/R): Undercut/Undercut Bank Stability: low
Fish Habitat	Excellent habitat for ninespine stickleback and Arctic char, several Arctic char were observed at the crossing site. Upstream of the crossing, low water levels have created impassable dry areas and cascades. Due to proximity to a lake (~20 m downstream), habitat at the crossing could be very important for young of the year and juvenile fish, particularly early in the year.	

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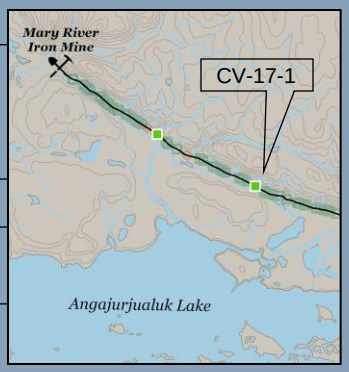

Predicted Environmental Impact	Proposed Mitigation
Direct loss of fish habitat from structure installation.	• If construction of the culvert crossings is determined to result in a Harmful Alteration, Disruption or Destruction (HADD) of fish habitat, DFO will determine appropriate measures to ensure “no net loss” . • Watercourse channel will be restored to the original stream flow characteristics.
Potential for fish stranding or mortality during construction	• As no Arctic Char spawning habitat is present, construction can occur during winter season when watercourses are typically dry or frozen to bottom to avoid impacts to fish passage. • Culvert will be monitored for blockages and cleaned when necessary. This will ensure passage of juvenile and adult fish • If construction occurs during open water season, withdrawal of any water will not exceed 10 % of the instantaneous flow, in order to maintain existing fish habitat
Potential for barriers to fish passage Long culverts (e.g. > 50 m) may impede fish passage due to the lack of light inside the culvert.	• Meet DFO requirements for fish passage in culvert design • The contractor will work with DFO to indentify means of providing as much light as possible in long culverts.
Potential for loss of riparian habitat within the footprint	• Restoration of riparian habitat and provision of culvert pools as required
Sediment effects and degradation of habitat (water quality) due to sediment or other contaminants both at the crossing and downstream	• Construction will follow practices outlined in Section 9.6 and Project EMS (DEIS, Vol. 10). • Timing of works in and adjacent to watercourses during winter construction window to avoid potential impacts to water quality and potential fish habitat downstream of the crossing.
Removal of vegetation at crossing locations.	• This removal should be kept to a minimum and within the right-of-way. • Approaches will be designed and constructed so that they are perpendicular to the watercourse to minimize loss or disturbance to riparian vegetation. • Any disturbed areas will be vegetated by planting and seeding native species and areas with be covered by mulch to prevent erosion and to help seeds germinate. • The site will be maintained until site is stabilized by vegetation.
Damage to stream banks from construction equipment increases the potential for erosion	• Operate machinery on land (above the HWM) and in a manner that minimizes disturbance to the banks of the watercourse. • Install effective sediment and erosion control measures before starting work to prevent the entry of sediment into the watercourse. Inspect these regularly during the course of construction and make all necessary repairs if any damage occurs.
Direct or indirect impact from blasting.	• If blasting is required near watercourse DFO Blasting Guideline (Wright and Hopky) will be met where possible
Potential for spills of fuel or other fluid from construction vehicles	• Adhere to contingency plans identified in the project EMS (DEIS, Volume 10). • Machinery is to arrive on site in a clean condition and is to be maintained free of fluid leaks. Wash, refuel and service machinery and store fuel and other materials for the machinery away from the water to prevent any deleterious substance from entering the water. Keep an emergency spill kit on site in case of fluid leaks or spills from machinery. • Use snow berms (if possible) to prevent deleterious substances from entering the watercourse.
Solid waste could foul the local environment and attract scavengers	• Solid waste generated at the crossing site will be removed from the site and disposed of in accordance with applicable Nunavut regulations.